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Autonomous morphology and extramorphological coherence

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Abstract Although the most familiar examples of autonomously morphological phenomena are entirely arbitrary, Aronoff's original (1994) proposal predicts that autonomous morphology is not limited to such cases, but is active in *all* mappings between phonology and morphosyntax, from morphological phenomena considered entirely arbitrary, to morphological phenomena which are to some degree correlated with extramorphological features. In this study I discuss evidence from Romance verb morphology for the existence of such a continuum, and explore approaches to situating morphological phenomena along it, from the starting point of the 'hierarchy of functional coherence' (a ranking of morphomes according to the degree to which they correspond to extramorphological criteria) put forward by Smith (2013). I suggest that it is worthwhile to distinguish between the phonological, morphosyntactic and morphosemantic coherence of a given morphome, firstly because these are qualitatively different phenomena, and secondly because phonological correlates appear to make a greater contribution to diachronic resilience.

Keywords Autonomous morphology · Morphological features · Inflectional morphology · Form-function relationships · Phonology-morphology interface · Romance languages

1 Introduction

The notion of the autonomy of morphology was first put forward by Aronoff (1994), who argues for morphology as an independent component of the grammar, mapping between phonology and syntax (1994:25). Following Aronoff's proposal, work on the

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paradigmatic distribution of inflectional material in Romance has identified a number of patterns (termed 'metamorphomes'[1] in unpublished work by Round) which appear independent of extramorphological factors such as semantics, syntax or phonology, but also, much more recently, some patterns which display partial correlation with extramorphological factors (see e.g. Maiden 2011b; Esher 2013; O'Neill 2013; Smith 2013). These latter studies indicate that there is no inherent discrete divide between morphological phenomena which are correlated with extramorphological factors such as semantics or phonology, and morphological phenomena with no extramorphological correlate. Instead, autonomously morphological phenomena may align exactly, partially, or not at all with extramorphological features. Furthermore, the extent of alignment may change over time: a distribution which originates with a transparent extramorphological motivation may gradually become opaque and arbitrary.

Together, these observations offer strong support for Aronoff's original proposal. In Aronoff's model, *all* mappings between phonology and syntax, whether one-to-one, entirely arbitrary, or somewhere between these two extremes, are mediated by the autonomously morphological component of the grammar, which he terms the 'morphomic level'. Comparative evidence from Romance, outlined in Sect. 2 below, shows that perfect alignment between a morphological paradigm distribution and an extramorphological correlate is rare; thus the morphomic level is crucial to most mappings between form and function. Diachronic evidence of changes from extra-morphologically motivated distributions to apparently 'arbitrary' distributions also points to the morphomic level being implicated in the intermediate stages, when the distribution retains partial extramorphological motivation.

The data surveyed in this paper serve not only to illustrate the reality of the continuum predicted by Aronoff's model (between morphological phenomena considered entirely arbitrary, and morphological phenomena which are to some degree correlated with extramorphological features), but also to exemplify the diversity of the extramorphological features involved (Sect. 3). The existence of such data highlights the need for proper articulation of the relationship between the morphomic level and other components of the grammar, the central question being: what (if any) bearing do extramorphological correlates have on the behaviour of morphomic distributions, notably their diachronic persistence?

The role of this study is exploratory and methodological, elucidating the key issues which will need to be addressed in order to understand the relationships between morphology and extramorphological factors, and their effect upon the behaviour of morphomic distributions. Some of these issues (Sects. 4.1, 4.2) are qualitative: it is necessary to establish what types of extramorphological correlate are possible for the distributions defined at the morphomic level, in order to investigate which are relevant for morphological behaviour. Others are quantitative: in order to compare the strength of potential extramorphological motivation for different morphomic patterns, and thus the relationship between strength of correlation with extramorphological

[1] Round's terminology usefully distinguishes between different types of morphomic phenomena while recalling their common status as morphomic. 'Metamorphome' refers to a set of cells within the inflectional paradigm, serving as a template for the paradigmatic distribution of roots, stems, and other inflectional material. 'Rhizomorphome' refers to an inflectional class, i.e. set of lexemes which share inflectional realisations (Aronoff 1994:64). This study focuses on metamorphomes.

factors and strength of morphomic template, one must establish a means of measuring the strength of potential extramorphological motivation. Approaches to developing a measure, and the attendant difficulties, are outlined in Sect. 4.4.

Some qualitative observations about the diachronic resilience of individual metamorphomes (i.e. abstract patterns of paradigmatic distribution; see footnote 1, and examples under Sect. 2 below) in the light of their extramorphological correlates are given in Sect. 5, based on the Romance data currently available. One might expect that metamorphomes which are strongly correlated with extramorphological properties would be more robust than metamorphomes which are only weakly (or not at all) correlated with such properties. However, investigation of Romance metamorphomes suggests that this is not necessarily the case, and that not all extramorphological correlates improve the diachronic resilience of morphomic distributions.

2 The continuum between externally motivated mappings and arbitrary mappings

The existence of an autonomous morphological component of grammar is most obvious in cases of significant mismatch between the distribution of a morphological form and the distribution of syntactic or semantic functions. Several such mismatches in Romance languages are identified by Maiden (e.g. 2005, 2011a): for instance, the surviving reflexes of Latin 'perfective' forms do not share any unique functional correlate (see Maiden 2011a:179–180), nor do they form a natural class, yet in the majority of Romance languages these forms systematically continue to present a shared root. In regular verbs this identity is real but trivial, as the entire paradigm shares a root; in irregular verbs, however, the continuants of Latin perfectives typically share a distinctive root. One such example from Castilian is shown in Table 1: for the irregular verb *hacer* 'do', all forms continuing Latin perfectives, in this case the preterite and both imperfect subjunctives, uniquely share a distinctive stem. As Maiden (2001, 2005) demonstrates, despite the lack of a unique functional correlate, the identity of root between the preterite and the imperfect subjunctive in Romance languages is extremely robust, to the extent that it acts as a template structuring analogical change. This recurrent set of paradigm cells, given the abstract label 'PYTA'[2] by Maiden, may be identified as a metamorphome. The systematic nature of such distributions, independently of extramorphological motivation (whether semantic, syntactic or phonological), offers compelling evidence for the existence of the morphomic level.

Aronoff's contention that the morphomic level is active in all mappings between syntax and phonology must necessarily include cases in which a morphological distribution corresponds exactly to a natural class. Although such one-to-one mappings are often considered the ideal form-meaning relationship,[3] in practice they are less

[2] Acronym from the Spanish expression *perfecto y tiempos afines* 'perfect and related tenses' used to refer to the continuants of Latin perfectives. It is not only legitimate but beneficial to give metamorphomes abstract labels, to allow discussion of formal distributions independently of associated functional content.

[3] Cf. 'Humboldt's Universal', the general claim that language change tends towards biunique relationships between form and function. Within the framework of Natural Morphology, Wurzel (1987:92) similarly posits a universal principle of 'Uniformity and Transparency' favouring biunique relationships between form and function in the specific case of inflectional morphology.

Table 1 *hacer* 'do', standard Castilian

	PRS.IND	PRS.SBJV	IMPF.IND	PRETERITE	IMPF.SBJV.SE	IMPF.SBJV.RA	FUT	COND
1SG	hago	haga	hacía	hice	hiciese	hiciera	haré	haría
2SG	haces	hagas	hacías	hiciste	hicieses	hicieras	harás	harías
3SG	hace	haga	hacía	hizo	hiciese	hiciera	hará	haría
1PL	hacemos	hagamos	hacíamos	hicimos	hiciésemos	hiciéramos	haremos	haríamos
2PL	hacéis	hagáis	hacíais	hicisteis	hicieseis	hicierais	haréis	haríais
3PL	hacen	hagan	hacían	hicieron	hiciesen	hicieran	harán	harían

IMPV.2SG	IMPV.2PL	INF	GERUND	PST.PTCP
haz	haced	hacer	haciendo	hecho

common than one might expect. For instance, taking the sample of data in Table 1 as an illustrative example, it is difficult to find such a mapping. The root *hag-* occurs throughout the present subjunctive, but also in the 1SG present indicative form—a grouping of cells which cannot be uniquely identified in terms of any syntactic or semantic property (and which Maiden–see e.g. Maiden 2009a–identifies as a further [meta]morphome, labelled L-pattern).[4] Forms presenting the root *hac-*/*haz-*[5] are variously and non-exhaustively associated with the contrasting properties indicative, imperative, finite, non-finite, present and past. As for the Romance synthetic future and synthetic conditional, which also share a root, values such as posteriority and possibility are certainly shared between these two screeves, but not uniquely, as the same values are found for the imperfect indicative. Only the past participle remains as a possible candidate for one-to-one mapping.[6]

The rarity of one-to-one mappings is not merely a property of irregular lexemes. Consider, for example, Italian first-conjugation verbs, which, for reasons of regular sound change, present a unique theme vowel /e/, instead of /a/ in, and only in, the synthetic future and synthetic conditional, as shown in Table 2. As the synthetic future and synthetic conditional have no unique functional correlate (see Esher 2013), neither the set 'synthetic future and synthetic conditional', to which I give the abstract label 'Fuèc',[7] nor the set 'whole paradigm minus Fuèc' can be considered a natural class mapping unambiguously to a single form.

[4]Abstract label referring to the shape of the pattern, which, in the traditional presentation of Romance verb paradigms, may be taken to resemble an inverted letter L. Note that Maiden's own work refers to the L-pattern as a 'morphome' rather than 'metamorphome' (though in Round's typology the L-pattern is an example of the latter).

[5]Note that the alternation between ⟨c⟩ and ⟨z⟩ in these and other forms is purely allographic.

[6]The past participle itself participates in the expression of the rather different notions 'perfective' and 'passive' (see Maiden 2013b:504–506 for discussion), although strictly speaking these meanings are associated with the periphrases *haber* 'have' + past participle and *ser* 'be' + past participle respectively, rather than with the participle in isolation.

[7]From the lexeme *fuèc* 'fire' in eastern varieties of Occitan, a near-acronym for the Occitan names of this metamorphome's constituent screeves, *futur e condicional* 'future and conditional'.

Table 2 *parlare* 'speak', standard Italian

	PRS.IND	PRS.SBJV	IMPF.IND	PRETERITE	IMPF.SBJV	FUT	COND
1SG	parlo	parli	parlavo	parlai	parlassi	parlerò	parlerei
2SG	parli	parli	parlavi	parlasti	parlassi	parlerai	parleresti
3SG	parla	parli	parlava	parlò	parlasse	parlerà	parlerebbe
1PL	parliamo	parliamo	parlavamo	parlammo	parlassimo	parleremo	parleremmo
2PL	parlate	parliate	parlavate	parlaste	parlaste	parlerete	parlereste
3PL	parlano	parlino	parlavano	parlarono	parlassero	parleranno	parlerebbero

Although few plausible examples of true one-to-one mapping exist in Romance, some distributions approach this 'ideal' relationship more closely than others. To capture this variation, Smith (2013) proposes a terminological distinction between 'overt' morphomes—distributions which lack a unique functional correlate and cannot be accounted for without recourse to autonomous morphology—and 'covert morphomes'—distributions which have a unique functional correlate. These labels reiterate the point that all paradigmatic distributions are defined at the morphomic level, and are thus morphomic functions: where a stem distribution aligns with a natural class, this does not entail that the distribution is less morphomic, but simply that it is less *visibly* morphomic, as the distribution could superficially be attributed to purely extramorphological factors.

Whether a given distribution is overtly or covertly morphomic can be subject to change over time. Shift from covert to overt is robustly attested for the morphome PYTA described above. In Latin, the distinctive *perfectum* stem was associated with the functional content 'perfective aspect'. Assuming that 'perfective' did constitute a semantically coherent category, the paradigmatic distribution of the *perfectum* stem accordingly constituted a near-covert morphome;[8] the reflexes of Latin perfective forms have subsequently undergone functional divergence such that the modern Romance forms now constitute an 'overt' morphome.

An important aspect of Aronoff's original proposal is that one should also expect to find morphomic patterns intermediate between the entirely overt and the entirely covert: distributions which are not completely arbitrary, but which do not show exact correlation with extramorphological features either. In effect, Aronoff predicts a continuum of distributions defined at the morphomic level, ranging from the fully overt to the fully covert. Empirical support for this prediction is provided by the existence of 'intermediate' patterns of paradigmatic stem distribution (see Sect. 3), but also by observed diachronic changes in the overtness or covertness of metamorphomes. The functional divergence of the reflexes of Latin perfectives, for instance, is most plau-

[8]It is possible that the identification of a category 'perfective aspect' in Latin may proceed more from observation of formal similarity than from common functional content (Martin Maiden (p.c.); see also Maiden 2013b:493), as in the example of the Castilian 'imperfect indicative' discussed by O'Neill (2013). Independently of this issue, the 'perfect participle', which might be assumed to share the value of perfectivity, presents not the *perfectum* stem, but the 'third stem' (so termed by Aronoff 1994). Thus, even if perfectivity is a coherent semantic category, the forms presenting the *perfectum* stem do not constitute a unique natural class of perfectives.

sibly considered a gradual process, in which the distribution PYTA progressively becomes more overt. In the absence of an immediate, discrete and catastrophic change in which all functional commonality is suddenly evacuated from PYTA, it is hard to sustain a view of the morphomic level as only active in the case of fully overt morphomes: at what point should this distinct morphological component to the grammar, generally bypassed by a direct mapping from syntax to phonology, suddenly spring into action as the sole factor determining the distribution of forms in the paradigm? By contrast, if the morphomic level is assumed to be active in all morphological distributions, a gradual change such as that observed for PYTA can be accounted for as an incremental shift in alignment between the patterns defined at existing and constant levels of grammatical structure (in this case, the morphomic and semantic components of the grammar).

3 Morphomic phenomena with extramorphological correlates

For those distributions which have some degree of extramorphological motivation, I propose the label 'partially overt morphomes'.[9] In such distributions, as in fully overt and fully covert morphomes, the morphomic level mediates mappings between form and meaning. However, in contrast to fully overt morphomes, partially overt morphomes additionally show a degree of correlation with extramorphological factors (whether phonology, syntax or semantics). Partially overt morphomes are nevertheless underdetermined by these extramorphological factors, which are insufficient in isolation to account for the observed pattern of morphological forms.

I outline below two established cases of partially overt morphomes, one in which the extramorphological correlate is phonological (Sect. 3.1; Maiden 2011b), and one in which the extramorphological correlate is semantic (Sect. 3.2; Esher 2013). Of cases in which morphomic distributions in Romance appear to show some correlation with, or even sensitivity to, extramorphological properties (some others, involving morphosyntactic, segmental and prosodic properties, are discussed in Sects. 4.2 and 5) these two are the clearest, and both additionally facilitate comparison between patterns which are similar in shape and in origin, but which differ in the degree to which they correlate with extramorphological factors.

3.1 A segmental phonological correlate: the L-pattern and U-pattern in Daco-Romance

In varieties of Daco-Romance, as in many Romance languages, ancient sound changes have produced patterns of stem alternation which are subsequently morphologised and serve as arbitrary, morphomic templates for morphological analogy. The 'U-pattern' in Daco-Romance {PRS.1SG, SBJV.1SG, SBJV.3SG, PRS.3PL, SBJV.3PL} results from historical palatalisation and affrication of velar stops before front vowels, while the 'L-pattern' {PRS.1SG, SBJV.1SG, SBJV.3SG, SBJV.3PL} results from

[9]The term 'weakly morphomic phenomena' used by Esher (2013) is misleading, as it suggests that such distributions are not wholly morphomic. This term is a case of overly narrow interpretation of 'morphomic'.

Table 3 U-pattern. *a zice* 'say', standard Romanian (Maiden 2011b). U-pattern cells are shaded

	1SG	2SG	3SG	1PL	2PL	3PL
PRS	zi[k]	zi[tʃ]i	zi[tʃ]e	zi[tʃ]em	zi[tʃ]eţi	zi[k]
SBJV	zi[k]	zi[tʃ]i	zi[k]ă	zi[tʃ]em	zi[tʃ]eţi	zi[k]ă
GERUND	zi[k]ând					

Table 4 L-pattern. *a vedea* 'see', early modern Romanian (Maiden 2011b). L-pattern cells are shaded

	1SG	2SG	3SG	1PL	2PL	3PL
PRS	vădzu	vedzi	vede	vedem	vedeţi	vădu
SBJV	vădzu	vedzi	vadză	vedem	vedeţi	vadză
GERUND	vădzându					

historical palatalisation of consonants before yod. The sound changes involved are comparable to those in other Romance languages, though it should be noted that the resulting metamorphomic patterns in Daco-Romance differ slightly in shape from 'cognate' metamorphomic patterns in other varieties.[10]

Examples of Daco-Romance L- and U-pattern distributions due to regular historical sound change are shown in Tables 3 and 4 (data from Maiden 2011b, given in standard orthography[11] apart from IPA characters within square brackets). Note also that, in some L-pattern verbs (as in Table 4), a palatalised alternant can occur outside the L-pattern cells, due to a separate, much more recent sound change in which any dental preceding an inflectional *-i* undergoes affrication (Maiden 2011b:78).

Although both these patterns originate from regular phonological processes, consideration of the historical evidence shows that they are subsequently enshrined as morphological distributions of stem alternation independent of phonology. Notably, the L- and U-pattern act as templates for morphological analogy: existing L-/U-pattern alternations are spread to additional lexemes in which regular sound change would not have produced allomorphy with a L-/U-pattern distribution; and novel pairs of alternants arise (e.g. /g/ vs. /d/) which, unlike the velar/palatal or dental/affricate alternations, have no precedent in sound change (see Maiden 2011b:67–70 and 2011b:70–71 for a detailed survey of analogy following the U-pattern and L-pattern templates respectively). Such behaviour is comparable to that of other morphomic distributions (see e.g. Maiden 2009a for extensive exemplification), which,

[10]The L-pattern elsewhere in Romance consists of the 1SG.PRS.IND form and all PRS.SBJV forms (as in the Castilian example in Table 1). The U-pattern elsewhere in Romance consists of 1SG.PRS.IND, 3PL.PRS.IND and all PRS.SBJV forms. References to the 'L-pattern' and 'U-pattern' in this section concern the Daco-Romance variants.

[11] ⟨ă⟩ = [ə]; ⟨â⟩ = [ɨ]; ⟨a⟩ = [a].

Table 5 *a vedea* 'see', modern standard Romanian (Maiden 2011b)

	1SG	2SG	3SG	1PL	2PL	3PL
PRS	văd	vezi	vede	vedem	vedeţi	văd
SBJV	văd	vezi	vadă	vedem	vedeţi	vadă
GERUND	văzând					

though of phonological origin, become morphologised and form stable distributional templates at the morphomic level.

The later development of the L- and U-patterns, however, reveals a significant difference between them: the U-pattern never subsequently undergoes analogical levelling, while the L-pattern is highly susceptible to levelling. Maiden (2011b) observes that this difference is correlated with a difference in phonological context. Although the U-pattern is demonstrably morphomic, the distinctive U-pattern alternant always occurs together with a non-front vowel in the desinence, and thus has a stable phonological cue. The L-pattern, on the other hand, does not present the distinctive alternant in the PRS.3PL form, disrupting the correlation between this alternant and non-front vowels. As Maiden observes, these data suggest strongly that the presence of a consistent phonological context in some way reinforces the U-pattern, while the absence of a consistent phonological context renders the L-pattern less robust and thus more vulnerable to levelling. Maiden additionally points out (2011b:81) that the relationship between the alternants and their context is phonologically natural in the case of the U-pattern (velars before non-front vowels, palatals before front vowels, as in Table 3) but not in the case of the L-pattern; thus the relative phonological naturalness of the environment favours the survival of U-pattern alternations, without actually determining the alternation.

The L- and U-patterns in Daco-Romance are thus partially overt metamorphomes. They are defined at the morphomic level, but are also correlated to some extent with phonological features: strongly in the case of the U-pattern, less so in the case of the L-pattern. A key characteristic of these distributions is that, while phonology is clearly significant in explaining their behaviour, it is not sufficient. This point is clearly shown by data concerning analogical levelling in the L-pattern. As mentioned above, the L-pattern is highly subject to levelling, which eliminates the distinctive L-pattern stem alternant from some or all of the L-pattern cells (the reader is referred to Maiden 2011b for details). In some verbs, such as *a vedea* (Table 4), a stem alternant resembling the L-pattern alternant is found in 2SG forms outside the L-pattern cells. One might expect that analogical levelling would equally affect both the L-pattern alternant and the 2SG alternant, given the phonological similarity (indeed, identity) between the forms involved. Yet this does not happen: analogical levelling evicts L-pattern alternants, but leaves the 2SG alternants intact (as illustrated by the modern forms of *a vedea*, Table 5; /z/ is the expected reflex of /dz/). Such differential behaviour cannot be explained unless the L-pattern is treated as morphomic (see Maiden 2011b:78–79).

Table 6 *poder* 'be able', Occitan (Toulouse, ALLOc (Ravier 1971–93) survey point 31.12)

	PRS.IND	IMPF.IND	PRS.SBJV	PRETERITE	IMPF.SBJV	SF	SC
1SG	pòdi	podiá	pòsque	posquèri	posquèsse	poirè	poiriá
2SG	pòdes	podiás	pòsques	posquères	posquèsses	poiràs	poiriás
3SG	pòt	podiá	pòsque	posquèt	posquèsse	poirà	poiriá
1PL	podèm	podiám	posquem	posquèrem	posquèssem	poirem	poiriám
2PL	podètz	podiátz	posquetz	posquèretz	posquèssetz	poiretz	poiriátz
3PL	pòden	podián	pòsquen	posquèran	posquèssen	poiràn	poirián

3.2 A semantic correlate: Fuèc in Gallo-Romance

Another example concerns partial semantic motivation in the Romance synthetic future (henceforth SF)[12] and synthetic conditional (henceforth SC) derived from infinitive + HABEO, etc. and infinitive + HABEBAM, etc. respectively. The original constructions are strictly parallel, sharing form and function; even today, their continuants typically share a stem, which is sometimes unique to the SF and SC within the paradigm, as exemplified in Table 6. Indeed, the set SF+SC (given the abstract label 'Fuèc') is demonstrably morphomic, serving as a distributional template for heteroclisis, suppletion and analogy (Esher 2012).

The formal parallelism of SF and SC in modern Romance languages is often explained as a result of functional parallelism—typically, expression of futurity by the SF, and of future-in-the-past by the SC. However, the extent to which SF and SC show functional parallelism varies between languages. In French, for example, functional parallelism is very strong, as the four major values associated with the SC (namely futurity, possibility, attenuation and conjecture, Dendale 2001) are also the four major values associated with the SF (Vet and Kampers-Manhe 2001). In several varieties of Occitan, by contrast, the SC does not express futurity or conjecture. Only the semantic values of possibility and attenuation are shared by the SF and SC (Esher 2013), and since these values are not unique to the SF and SC, the distribution Fuèc cannot be reduced to a natural class.[13]

It would be quite inaccurate to claim that there is no functional commonality between the SF and SC in Occitan; nevertheless, the precise extent of the distribution Fuèc cannot be explained by appeal to functional commonality alone. Fuèc is thus a further case of a distribution defined at the morphomic level, but which is partially correlated with extramorphological (in this case semantic) features—in the terms of this article, a partially overt metamorphome. In contrast to the Daco-Romance data discussed above, however, the degree of functional commonality shown by Fuèc in different languages does not appear to be linked to the resilience of the distribution. I return to this point in Sect. 5 below.

[12]The abstract labels SF and SC are introduced as a means to refer to morphological forms independently of the functions associated with them.

[13]Detailed exemplification and discussion of the French and Occitan data fall outside the scope of this article. The interested reader is referred to the studies cited.

3.3 Summary

The distributions discussed above are concrete examples of morphomic distributions intermediate between the overt and the covert. They demonstrate that, as predicted by Aronoff (1994), there exist distributions which are partially correlated with extramorphological features, but which do not have a unique extramorphological correlate, and the behaviour of which cannot be fully accounted for without reference to autonomous morphology. As such, they offer support for a view of morphology in which all mappings between form and meaning are mediated by the morphomic level, and in which a distribution may map exactly, partially or not at all onto one or more extramorphological correlates (the comparisons drawn by Maiden 2009a between the L-pattern in Daco-Romance and the U-pattern in Daco-Romance, and by Esher 2013 between Fuèc in French and Fuèc in Occitan, show that morphomic patterns are correlated with extramorphological features to varying degrees, and thus offer support for the view that the 'overtness' of a morphome can vary along a continuous range between the extreme values 'fully overt' and 'fully covert'). The data further show that the presence of a functional correlate or motivation in some morphological mappings does not constitute grounds for assuming that these mappings do not involve the morphomic level; just as the existence of interface phenomena between phonology and syntax does not compromise the existence or autonomy of either component of the grammar.

4 Identifying, classifying and measuring extramorphological correlates

The examples discussed above show that metamorphomes present extramorphological correlates of different types and in varying degrees. This being so, what types of extramorphological correlate are possible and how can they be identified? Can the degree of correlation between metamorphomes and extramorphological properties be quantified, to facilitate comparison between metamorphomes in different varieties or historical periods, and what is the most informative way of doing so? In this section, I examine the theoretical issues surrounding these questions, from the starting point of an existing proposal for classification and ranking of metamorphomes according to their extramorphological 'coherence'.

4.1 Smith's notion of 'functional coherence'

Smith (2013) proposes that all metamorphomes can be situated along a cline of 'functional coherence', as exemplified in Table 7 for Romance. In this model, morphomes are assigned to one of three categories: 'functionally coherent' morphomes corresponding to morphosyntactic or semantic natural classes; 'TAM' (tense, aspect, mood) morphomes such as PYTA, which are defined in terms of categories internal to the verb, grouping together entire screeves; and 'person-related' morphomes such as the L-pattern,[14] which make reference to agreement categories not inherent to the

[14]Note that Smith's paper refers to the standard Romance L-pattern (1SG.PRS.IND and all PRS.SBJV cells) and U-pattern (L-pattern cells plus 3PL.PRS.IND). The Daco-Romance variants discussed in Sect. 3.1 above are not included in Smith's hierarchy.

Table 7 Hierarchy of functional coherence (adapted from Smith 2013:260)

More coherent					Less coherent
Functionally coherent stems	TAM morphomes		Person-related morphomes		
	FUÈC	PYTA	N-pattern	L-pattern	U-pattern
Suppletion					
Defectivity					

verb, but which typically also require reference to TAM categories. These three categories form a hierarchy which is assumed to reflect the overall degree of functional coherence of each morphome: for instance, any TAM morphome would be, overall, more coherent than any person-related morphome. Within the three overarching categories, morphomes are further ranked (see Smith 2013:250–256 for discussion) according to criteria such as semantic content (e.g. the SF and SC share a number of semantic values whereas the preterite and imperfect subjunctive do not), markedness (e.g. the N-pattern consists of cells instantiating the least marked categories 'present', 'singular' and 'third person', whereas the L-pattern includes cells from more marked categories), and pragmatic features (e.g. the L-pattern cells might be described as speaker-oriented, whereas the U-pattern cells share no common feature). Thus, in Smith's model, the term 'functional coherence' covers a wide range of distinct attributes.

Smith's hierarchy is in part motivated by the observation that the morphological phenomena suppletion and defectivity most commonly occur in the morphomes to the left of the table, namely those which are more 'coherent'. Although such evidence does not discriminate clearly between the major groupings 'functionally coherent stems', 'TAM morphomes' and 'person-related morphomes', there is certainly a demonstrable gradation between the N-, L- and U-patterns. Among these last, suppletion is only found in the N-pattern, while defectivity can follow either an N-pattern or L-pattern distribution, but neither phenomenon takes the U-pattern as a template. The data adduced by Smith thus reiterate the notion of a continuum in the extent of extramorphological motivation.

Smith (2013) is, to my knowledge, the first proposal for a typology of morphomic distributions which makes reference to extramorphological correlates, and also to the potential relationship between extramorphological correlates and the behaviour of morphomic distributions. In the following sections, I explore in more detail some issues raised by the central assumptions of this proposal, which will be important in understanding the types of extramorphological correlate which may require consideration, the information conveyed by different measures of extramorphological correlation, and thus how the continuum between motivated and arbitrary distributions may be conceived (approaches situating morphomic distributions along a unified ranking from most motivated to most arbitrary, and approaches situating these distributions within a multidimensional space distinguishing different types of motivation, are equally compatible with the notion of such a continuum, but represent very different theoretical understandings of the nature of the continuum). A key characteristic of Smith's hierarchy is that it constitutes a single ranking of morphomic distributions based on their overall 'functional coherence'. However, the hierarchy is

compiled using a diverse combination of 'functional' correlates, including syntactic, semantic and pragmatic features. Furthermore, the notion of 'functional coherence' must be clearly differentiated from the wider concept of 'extramorphological correlates', since Smith's typology does not make reference to phonological features. I discuss below the means of distinguishing the different types of correlate, the relevance of phonology, the grounds for the distinction between TAM and person-related morphomes, and the respective advantages of quantifying the overall degree to which a given morphome is correlated with extramorphological features, as opposed to the strength of its correlation with individual types of extramorphological feature.

4.2 Morphological paradigms and morphosyntactic/semantic feature values

The distinction between TAM morphomes and person-related morphomes occupies a central role in Smith's hierarchy. However, this distinction is not readily captured in terms of extramorphological content, since it refers to subgroupings of cells within a morphome, rather than to the morphome as a whole. The fact that a morphome can be defined in terms of a particular class of feature (e.g. TAM) does not entail that any of the feature values instantiated for the various constituent cells of the morphome (e.g. present, imperfective, indicative) is shared by all, or even a majority, of the cells of the morphome. Moreover, person-related morphomes and TAM morphomes often instantiate an equivalent range of person, number and TAM features: the TAM morphome PYTA includes first, second and third person forms, singular and plural forms, and indicative and subjunctive forms, just as the person-related L- and U-patterns do.

Rather than being directly related to extramorphological features, the distinction between TAM and person-related morphomes is thus concerned with the bundles of feature values which act as arbitrary labels for subdivisions of the paradigm. In effect, this distinction is a measure of how well a given morphome maps onto existing screeves and person/number combinations. It is only related to extramorphological properties insofar as screeves and person/number combinations themselves correspond to extramorphological properties. While person and number features are relevant to and visible in syntax, the screeve is defined by form rather than function, meaning that it is either theory-internal (an artefact of linguists' descriptions) or morphology-internal (a formal element of the paradigm).

The nature of the screeve as a morphological construct is eloquently shown by O'Neill's (2013) discussion of the Spanish paradigm category labelled 'imperfect indicative', a consistent set of forms with a supposedly consistent set of TAM feature values. O'Neill identifies at least 15 distinct usages for this screeve, including not only familiar values such as 'iterative', 'habitual' and 'durative', but also usages in which 'imperfect indicative' forms express temporal posteriority, counterfactuality, evidentiality, attenuation and possibility. Although the 'imperfect indicative' is usually considered a 'past tense', it can be used to refer to the present and future, and can refer to alternative possible worlds as well as to the real world canonically associated with the indicative. As O'Neill points out, many of these usages are commonly attested for 'imperfective' forms crosslinguistically, and it is possible to discern semantic links between subgroups of usages: 'it is often apparent that a particular usage

X has evolved from a usage Y based on some type of common or overlapping conceptual semantics' (2013:236). However, O'Neill finds it impossible to make a generalisation encompassing all usages. He argues instead that the 'imperfect indicative' is assumed to be a meaningful morphosyntactic category purely because it corresponds to a single set of morphologically identifiable forms for each conjugational class, and that the single form is used as a justification for assuming that there is only one category, despite the widely varying usages.[15]

O'Neill's work reverses the perception of morphosyntactic/semantic features. Rather than being primitives (as the conventional labelling of morphological paradigm categories tends to imply), many such features in fact proceed from the existence of formally distinct screeves: they are 'dependent on the morphology and not vice versa' (O'Neill 2013:240). The characterisation of screeves in terms of features is thus not driven exclusively or even primarily by extramorphological factors: instead, the features are fundamentally abstract labels used to describe the overall structure of the paradigm.

Indeed, as extensively discussed and exemplified by Corbett (2012), the question of which, if any, features can be justified independently of morphology reveals a significant contrast between the nature of most TAM features and the nature of person or number.[16] Evidence for person and number features comes not merely from speakers' interpretation of what a form means, but from syntactic agreement phenomena: 'plural' verb forms in Romance, for instance, co-occur with subjects bearing markers of plurality. Such phenomena provide robust extramorphological evidence, on the basis of which a discrete set of possible feature values can be proposed; person and number can be considered 'morphosyntactic' features, because they have relevance for syntax as well as for morphology.

TAM features, on the other hand, are typically 'morphosemantic' features (Corbett 2012:49). Speakers perceive a contrast between different values of TAM features, but this difference in semantic content is rarely relevant to syntax. An illustrative example from standard Gascon is given in Table 8 (data from Romieu and Bianchi 2005): the contrasts of meaning between the five different forms[17] shown are real to speakers, but these contrasts are not reflected by any systematic contrast in syntax. Indeed, perhaps the only viable candidate for morphosyntactic status among TAM features in this variety is the distinction between 'subjunctive' and 'non-subjunctive' forms. The 'present subjunctive' *cante* and 'imperfect subjunctive' *cantèsse* are largely confined to subordinate clauses introduced by a restricted range of expressions (e.g. *caler que*

[15]Correspondingly, one might consider that there are two 'imperfect subjunctive' screeves in Spanish. There are clearly two formally distinct, morphologically identifiable sets of forms, the *-ra* series (reflexes of the Latin pluperfect indicative) and the *-se* series (reflexes of the Latin pluperfect subjunctive); however, functional distinctions between the two are minimal (see e.g. DeMello 1993). Lunn (1995:437) makes the interesting observation that the value 'pluperfect indicative' which can still be expressed by the *-ra* form has been spread to the *-se* form.

[16]I am deeply grateful to Grev Corbett for clarifying my thinking on the relationship between morphosyntactic and morphosemantic features in the Romance data discussed here.

[17]The examples are 3SG word-forms of the first-conjugation *cantar* 'sing', but this choice of example should not be considered of theoretical significance; any consistent person/number value for any given lexeme of any conjugational class would illustrate the same point equally well.

Table 8 'Non-subjunctive' screeves and the usages associated with them in standard Gascon (after Romieu and Bianchi 2005)

	'present indicative'	'imperfect indicative'	'preterite'	'future'	'conditional'
3SG form	*canta*	*cantava*	*cantè*	*cantarà*	*cantaré*
Associated meanings	present	durative	perfective	future	future-in-the-past
	past	iterative	past	possibility	possibility
	future	imperfective		attenuation	conjecture
	habitual	possibility		conjecture	
	general truth	attenuation			
		past			

'be necessary that', *voler que* 'want that', *tà que* 'so that'), whereas the screeves exemplified in Table 8 are not subject to such a restriction. Even this distinction, though, is not watertight, as both subjunctive forms can occur in main clauses, expressing a desire or hypothesis (Romieu and Bianchi 2005:335–36). 'Subjunctive' and 'non-subjunctive' may be possible candidates for morphosyntactic feature-hood, though the evidence in favour of this analysis is less systematic and compelling than that for the morphosyntactic status of person and number features.

The lack of external evidence discriminating between morphosemantic features is a major obstacle to establishing a reliable inventory of such features and their possible values. For example, although the verb system of modern French has been extensively documented, and there is general agreement as to the usages attached to each screeve, there is no consensus on the [morphosemantic] features which should be invoked to describe the system (for a selection of concurrent proposals, see e.g. Touratier 1996; Dendale and Tasmowski 2001; Barceló and Bres 2006). The general problem of distinguishing morphosemantic features is compounded by the fluidity of change in the semantic content associated with each screeve, and thus in the nature of the semantic contrasts between screeves. Such fluidity contrasts with the long-term persistence of formal paradigm categories: for example, the reflexes of the Latin pluperfect indicative found in Ibero-Romance and Occitan varieties still retain their identity of stem with the other reflexes of Latin perfectives, while the central functions of this screeve have changed dramatically, the pluperfect meaning being supplanted by counterfactuality, epistemic modality or future-in-the-past.

Morphosemantic features are thus not a robust means to characterise the formal, morphological structure of a paradigm. Instead, I propose to consider the paradigm as an array of screeves differentiated primarily by form, and to consider morphosemantic features as external properties which may be freely associated with one or more screeves. A schematic representation of this view is given in Fig. 1, based on the data in Table 8:[18] the morphological paradigm consists of a set of forms organised into screeves, each screeve being associated with a number of extramorphological values which are relevant for the interpretation of the form in context but do not define

[18] As before, the 3SG forms of *cantar* 'sing' are given purely for illustrative purposes, to represent the screeves involved. The use of these forms should not be taken to imply any theoretical claim about what labels (if any) speakers use for screeves, or about the status of 3SG forms within the paradigm.

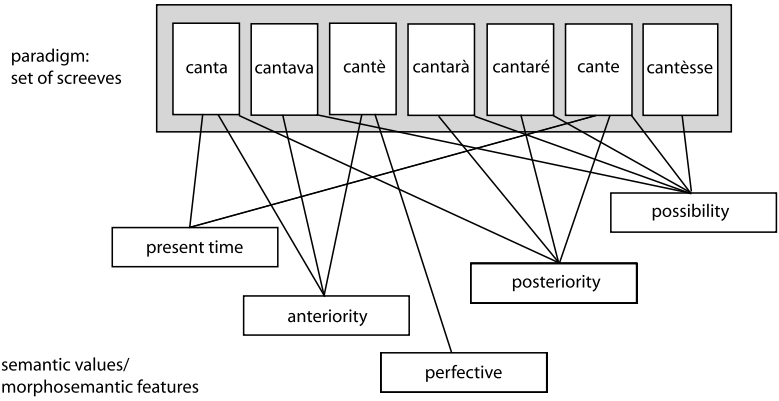

Fig. 1 Association of morphosemantic features with screeves

the structure of the paradigm. Such an approach facilitates description of semantic changes over time, and readily handles the diversity, overlap and variability of pairings between screeves and usages or semantic values. Most importantly, dissociation of morphological form from morphosemantic feature values avoids claiming semantic grounds for distinctions [between screeves] which are fundamentally driven by form.

In summary, the proposed distinction between TAM and person-related morphomes is not of import for evaluating extramorphological coherence, since it refers to intra- rather than extra-morphological criteria. However, consideration of this distinction highlights an important contrast between two independent, qualitatively different types of extramorphological coherence which can be demonstrated by a morphomic distribution: coherence in terms of independently verifiable morphosyntactic feature values, and coherence in terms of associated semantic values.

4.3 The place of phonology

As the label 'functional coherence' suggests, Smith's hierarchy is based upon what might be described as 'meaningful' functional content (chiefly morphosyntactic and morphosemantic), as opposed to extramorphological properties in general; this model consequently does not make reference to phonology. However, the Daco-Romance data described in Sect. 3.1 above indicate that morphomes can also have phonological correlates, and that such correlates are of potential significance for their diachronic development. An overall model of more general, 'extramorphological' coherence should thus include phonological coherence. Aspects of phonological context which may plausibly be considered for Romance metamorphomes include the identity of segments surrounding the distinctive alternant, and the placement of stress within the word-forms involved. The autonomy of phonology with respect to syntax and semantics indicates that phonological coherence should be considered orthogonal to the existing categories of morphosyntactic and morphosemantic coherence. This proposal is also consistent with the concept of the morphomic level mapping between

meaning (with potential morphosyntactic and semantic coherence) and form (with potential phonological coherence).

Yet there is a particular difficulty in the proper identification of phonological coherence. Unlike morphosemantic or morphosyntactic content, which are properties associated with cells or word-forms independently of their morphological form, phonological content can act as an *exponent* of metamorphomes. Indeed, phonological content has generally offered the first step to identifying the various metamorphomes discussed in this paper: distributions such as PYTA and the L-pattern are recognisable precisely because, in many lexemes, their constituent cells share a stem alternant which is phonologically distinct from the stem alternants found elsewhere in the paradigm. Identification of phonological coherence thus requires phonological *contexts or processes* affecting a paradigmatic distribution to be distinguished from the phonological *content* conforming to the distribution. While the distinction between content and process is conceptually clear, it can be difficult to effect in practice. Almost any inflectional material can be redistributed according to metamorphomic templates, and thus recourse to diachronic data is sometimes the only means of confirming whether a given phonological context is genuinely independent of morphology.

Metamorphomes are most familiar as templates for stem distribution; as extensively demonstrated by Maiden (2005, 2011a) it is common for identity of stem shape across the constituent cells of a metamorphome to be preserved in diachrony. For any given lexeme, analogical change typically affects a metamorphome in its entirety; if a novel alternant is introduced into a subset of cells by analogical change, it is typically spread to the entirety of the metamorphome. In either case, '[t]he relationship of mutual implication between "cells" always survives intact' (Maiden 2005:139). Maiden (2005) labels this tendency 'coherence'; for clarity, I will refer to it here as 'formal coherence'. While formal coherence has most often been observed with respect to roots and stems, it can also determine the distribution of other inflectional elements, including thematic vowels and person/number markers, as in the examples discussed below.

Maiden (2009b) presents data from Daco-Romance varieties in which inflectional formatives have been analogically extended, across screeves, but only within the domain of the morphome PYTA. In modern standard Romanian, PYTA consists of the preterite and the 'pluperfect' (reflex of the Latin pluperfect subjunctive), while at earlier historical stages and in some other modern Daco-Romance varieties, PYTA also included the 'conditional' (reflex of the Latin future perfect, future perfect subjunctive or both, Maiden 2009b). For modern standard Romanian, PYTA is thus coextensive with the natural class of forms with the morphosemantic feature 'anteriority'—an example of one-to-one mapping between form and meaning via the morphomic level, or, in Smith's terms, a 'covert' morphome, with a unique functional correlate; and this state of affairs may even obtain in varieties retaining the conditional, since the Daco-Romance conditional also tends to express anteriority (though it is not clear that it necessarily or invariably does so; Martin Maiden, p.c.). Assuming that the mapping between the domain of Daco-Romance PYTA and the domain of the feature 'anteriority' is one-to-one, it is in fact impossible to discern whether the spread of inflectional formatives within this domain is due to morphosemantic motivation, purely

Table 9 *a face* 'do', standard Romanian

	PRS	IMPF	SBJV	PRETERITE	PLPF
1SG	fac	făceam	fac	făcui	făcusem
2SG	faci	făceai	faci	făcuşi	făcuseşi
3SG	face	făcea	facă	făcu	făcuse
1PL	facem	făceam	facem	făcurăm	făcuserăm
2PL	faceţi	făceaţi	faceţi	făcurăţi	făcuserăţi
3PL	fac	făceau	facă	făcură	făcuseră

to the morphomic template, or to both at once.[19] The domain of each is equivalent, and thus, whatever the reason, the resulting distribution of inflectional formatives corresponds to an existing morphomic template.

Three inflectional formatives are affected by this development. The 2SG marker *-ş(i)*, originally confined to the pluperfect, has undergone analogical extension across all and only all PYTA screeves; an equivalent development has occurred, in sixteenth-century Romanian and some modern Daco-Romance varieties, for the 2PL marker *-t(u)*, previously confined to the preterite; and a plural formative *-ră-*, which was originally present only in the 3PL preterite form, has spread into all plural forms of the preterite and pluperfect (Table 9). The domain for these formatives is thus redefined as the intersection of the PYTA cells and the respective morphosyntactic features 2SG, 2PL and PL. A significant point about the formatives *-ş(i)*, *-t(u)* and *-ră-* is that they cannot be treated as part of a *stem* common to all PYTA forms. All three occur outside formatives unique to particular screeves, such as the *-se-* characteristic of the pluperfect (O'Neill 2014). These Daco-Romance data indicate that not only stems, but also person/number markers, and any intermediate material, can be analogically redistributed according to metamorphomic templates.

O'Neill (2014) also adduces many examples of the spread of a single thematic vowel through the PYTA cells in varieties of Ibero-Romance and Occitan. For instance, in some Occitan varieties of Gascony, the thematic vowel *-è-* (/ɛ/, etymological in the 1SG preterite) has replaced *-a-* (/a/, etymological in all other PYTA cells) throughout first-conjugation PYTA forms, and innovative *-ó-* (/u/) has spread throughout all third-conjugation PYTA forms (see e.g. Romieu and Bianchi 2005).

From the point of view of consistency of segmental phonological environment in synchrony, PYTA in a Gascon variety, with theme vowel /u/ distributed as in Table 10, superficially scores higher than the Daco-Romance U-pattern discussed under Sect. 3.1 above. Whereas the Daco-Romance distinctive U-pattern alternant is consistently found before a non-front vowel, the distinctive PYTA alternant is consistently found before the single vowel /u/. But the significance of this observation is dubious, since in the Daco-Romance case the consistent phonological environment predates

[19] Compare the discussion of the N-pattern in the Rhaeto-Romance variety Surmiran (Anderson 2008, 2011, 2013; Maiden 2011c). In Surmiran, the domains of rhizotonic stress and N-pattern distinctive alternants are exactly coextensive, with the result that neither a morphological account nor a phonological account can be preferred to the exclusion of the other.

Table 10 *bàter* 'beat', standard Gascon (Romieu and Bianchi 2005:302)

	PRS.IND	IMPF.IND	PRS.SBJV	PRETERITE	IMPF.SBJV	SF	SC
1SG	bati	batèvi	bati	batoi	batossi	baterèi	baterí
2SG	bates	batèvas	bàtias	batós	batosses	bateràs	baterés
3SG	bat	batèva	bàtia	bató	batosse	baterà	bateré
1PL	batem	batèvam	batiam	batom	batóssem	bateram	baterem
2PL	batetz	batèvatz	batiatz	batotz	batóssetz	bateratz	bateretz
3PL	baten	batèvan	bàtian	batón	batossen	bateràn	baterén

Table 11 *avere* 'have', standard Italian

	PRS.IND	PRS.SBJV	IMPF.IND	PRETERITE	IMPF.SBJV	FUT	COND
1SG	ho	abbia	avevo	ebbi	avessi	avrò	avrei
2SG	hai	abbia	avevi	avesti	avessi	avrai	avresti
3SG	ha	abbia	aveva	ebbe	avesse	avrà	avrebbe
1PL	abbiamo	abbiamo	avevamo	avemmo	avessimo	avremo	avremmo
2PL	avete	abbiate	avevate	aveste	aveste	avrete	avreste
3PL	hanno	abbiano	avevano	ebbero	avessero	avranno	avrebbero

and is independent of the existence of the U-pattern, whereas in the Gascon case the consistent phonological environment is historically motivated by formal coherence of the metamorphome PYTA. The fact that metamorphomes can apparently act as a template for the distribution of any morphological formative, whether stem, desinence or intermediate elements, demonstrates the importance of the morphomic level in inflectional morphology. However, it constitutes a significant handicap in identifying possible phonological correlates for morphological distributions, since no inflectional element can be considered independent evidence on the sole basis of its position or status within the word-form.

The expression of formal coherence is not confined to segmental phenomena. It is, for instance, well documented (see e.g. Maiden 2000) that in Italo-Romance varieties, the etymological, distinctive PYTA root has been confined to the 1SG, 3SG and 3PL forms of the preterite, which are rhizotonic,[20] whereas the distinctive root has been evicted from the imperfect subjunctive and from all other preterite cells, in favour of a root shared with, among other forms, the imperfect indicative. The resulting distribution is exemplified in Table 11. Superficially, the analogical change appears to align the distribution of morphological stem alternants on an existing phonological cue. Yet stress assignment has been lexically specified in Italo-Romance from an early period (Loporcaro 2011), and thus cannot be attributed to general phonological principles. Indeed, the pattern of stress alternation can itself be viewed as morphomic, in which case the changes of paradigmatic stem distribution observed in Italo-Romance do not

[20]The distinctive root was also conserved in the rhizotonic forms of the (now defunct) reflex of the Latin pluperfect indicative (Maiden 2000).

represent alignment of a metamorphome with an extramorphological property, but rather alignment between one metamorphome (PYTA) and another (the set of rhizotonic cells). Under this view, rhizotony and arrhizotony in Romance languages with lexically specified stress are likely to be exponents of metamorphomes rather than external correlates for such distributions.

Among the striking points which emerge from the data above is the frequent recourse to diachronic evidence which proves necessary in order to untangle independent phonological properties from phonological properties deriving from morphology, and thus distinguish genuine cases of external phonological motivation (which contributes to the resilience of a metamorphome) from cases of 'formal coherence' in the sense of Maiden (2005), which is a manifestation of that resilience. This is a significant methodological drawback. If phonological coherence is salient for speakers, as Maiden's (2009a) Daco-Romance data suggest, it must operate in synchrony (at least in the acquisition process, Maiden 2013b:498), and should be identifiable in synchrony, just as morphosyntactic and morphosemantic coherence are. Establishing a principled measure of phonological coherence thus first needs to surmount the apparent theoretical difficulties in reliably identifying phonological coherence.

4.4 Interim summary

While metamorphomes plausibly display 'extramorphological coherence' to different degrees, there are also differences in the type of coherence which they present. Morphosyntactic and morphosemantic features are qualitatively distinct, and neither type of feature corresponds to phonological attributes such as the following non-front vowels which are of importance to the Daco-Romance U-pattern. It follows that a morphomic distribution should be able to display any or all of three types of extramorphological coherence—phonological (degree to which member cells share phonological attributes), morphosyntactic (degree to which member cells share morphosyntactic feature values) and morphosemantic (degree to which member cells share morphosemantic values)—and that these three types are independent of each other. The typology of Smith (2013) suggests that pragmatic features may also need to be considered, though this departs further from Aronoff's model, in which the morphomic level maps between (and is thus crucially associated with) phonological forms and morphosyntactic features; Smith himself expresses reservations (2013:256) as to the importance of pragmatic features.

4.5 Can extramorphological coherence usefully be quantified?

How a measure of extramorphological coherence is constructed depends to a large extent on what it is intended to achieve. Measures of individual types of coherence can be constructed independently, with reference purely to the phonological, morphosyntactic or morphosemantic features involved, whereas a measure of overall extramorphological coherence must either combine the results of individual measures or apply directly to data from all types; such combination raises issues of comparability and the respective weighting of the different types. At either level, the degree of extramorphological coherence might be understood in one of two different ways: how near a

morphome is to having a unique extramorphological correlate, or how similar[21] the constituent cells of a morphome are to each other. Because these interpretations of extramorphological coherence are conceptually distinct from one another, they may be incommensurable.

Assuming that a set of feature values can be defined for each cell, the most straightforward approach would be to calculate the average similarity between the constituent cells of a morphome (i.e. the extent to which the feature values associated with any individual cell of the morphome are also associated with the other cells of the morphome). For instance, a measure of morphosyntactic coherence could be obtained by the following method. First, the set of applicable morphosyntactic features is defined, and all morphosyntactic feature values for each cell are listed. All possible pairings of cells within the morphome are identified, and for each pair, the percentage similarity between the feature sets of the two cells is calculated. Finally, the mean average of similarity across all pairs is taken.[22]

An approach such as this provides a consistent measure applicable to morphomic distributions of all shapes and sizes, and gives equal consideration to all attributes of all constituent cells of a morphome, as opposed to picking out certain features or values as more worthy of attention than others. Furthermore, evaluating coherence in terms of similarity between cells is consistent with current models of inflectional systems, which consider that speakers' knowledge of morphological paradigms and the stem distributions within them is probabilistic, centring on implicational relationships between individual cells (see e.g. Ackerman et al. 2009; Milin et al. 2009; Bonami 2012).

There are, however, two potentially significant situations which this measure will not signal as a matter of course: cases in which a given feature value is shared by all cells of a metamorphome, and cases in which a given feature value is *uniquely* shared by all cells of a metamorphome.

Distributions where a feature value is shared by all cells of a metamorphome are highly likely to be identified as possible instances of extramorphological motivation by a linguist observing paradigm forms and categories. By contrast, such distributions would not necessarily be singled out as highly coherent under a measure of average similarity between cells: if only one feature is shared by all cells of a metamorphome, but many other, disparate, features are represented within that metamorphome, the similarity due to the shared feature value may not greatly outweigh the differences due to the mass of disparate feature values. Using a measure of average similarity between cells will more reliably focus attention on morphomes which present bundles

[21] In terms of the extramorphological properties associated with the cells.

[22] An illustrative example: for Romance, one might assume (cf. Sect. 4.1 above) the morphosyntactic feature set {IND, SBJV, SG, PL, PERS1, PERS2, PERS3}. In this system, the cells comprising the Ibero-Romance L-pattern would be defined as {1.SG.IND, 1.SG.SBJV, 2.SG.SBJV, 3.SG.SBJV, 1.PL.SBJV, 2.PL.SBJV, 3.PL.SBJV}. There are 21 possible pairs of cells within this morphome: 6 pairings of 1.SG.IND with each of the SBJV cells, and 15 pairings of each SBJV cell with each other SBJV cell. Similarity between the pair 1.SG.IND and 1.SG.SBJV is 66.7 % (3sig.fig.), since they share two out of three possible features, while similarity between 1.SG.IND and 2.SG.SBJV is 33.3 % (one shared feature), and similarity between 1.SG.IND and 3.PL.SBJV is 0 % (no shared features). Of the 21 possible pairings, 10 have 66.7 % similarity, 9 have 33.3 % similarity, and 2 have 0 % similarity; the mean similarity of cells within this metamorphome is 46.0 %.

of shared features and thus strong functional coherence in one or more of the three domains.

The more significant theoretical question is raised by distributions where a feature value is uniquely shared. Because a measure of average similarity only compares cells within a morphome, and does not contrast these cells with the rest of the paradigm, it has no means of identifying whether a given feature value does or does not occur in cells external to the morphome. As a result, calculating average functional similarity between the cells of a morphome will not flag up morphomes which correspond to natural classes, and will therefore not distinguish between overt and covert morphomes.

What this last point brings into focus is the important distinction between the extramorphological coherence of a morphome and the status of that morphome as overt, partially overt or covert. Extramorphological coherence is most plausibly a continuous, quantitative variable, whereas the notions of 'overt' and 'covert' are mutually exclusive, qualitative properties, associated with the closeness of fit between a morphomic distribution and the distribution of an individual feature value. In a 'covert' morphome, all cells uniquely share at least one value, which may be phonological, morphosyntactic or morphosemantic: the covert nature of the morphome is independent of its overall extramorphological coherence. 'Overt' morphomes have no unique extramorphological correlate of any type; 'partially overt' morphomes are a subset of 'overt' morphomes, in which common but non-unique extramorphological content can be discerned. It should further be noted that the classification of morphomes as 'overt' or 'covert' abstracts away from the precise nature of the extramorphological coherence involved; as, indeed, would a ranking of morphomes based on 'overall' extramorphological coherence, combining scores for all three components.

Identifying and measuring extramorphological coherence offers a means of assessing the explanatory power of such coherence with respect to the behaviour of morphomic distributions, including their diachronic resilience: by comparing how coherent and how robust morphomic distributions are, we can establish which (if any) elements of extramorphological coherence are significant in motivating the survival and spread of such distributions in a given variety. As discussed in the following section, such comparison is important, because intuitive ideas about the relationship between coherence and resilience do not wholly correspond to the reality of the data set currently available.

5 Extramorphological motivation and diachronic resilience

Where a morphomic distribution is exactly aligned with one or more extramorphological correlates—Aronoff's one-to-one mappings—the pattern of distribution in question is relevant to the speaker not only at the abstract, morphomic level where the pattern of forms is defined, but also in one or more of the extramorphological components of the grammar between which the morphomic level maps. One might therefore imagine that morphomic distributions which are aligned with extramorphological correlates would be more strongly motivated and potentially more stable in diachrony. Yet diachronic data show that this is not necessarily the case, especially

where the extramorphological correlate is morphosemantic. The history of PYTA and Fuèc in several Romance varieties is illuminating in this respect.

The constituent screeves of both PYTA and Fuèc have undergone functional divergence to varying degrees, such that these morphomes are now, to varying degrees, overt. For PYTA in most Romance varieties, the (assumed) common value of 'perfective aspect' originally associated (even if not uniquely or exhaustively) with the *perfectum* stem can no longer be considered a functional correlate for the modern reflexes of this stem, but the latter still retain their formal commonality. PYTA is among the classic examples of overt morphomes, except in the Daco-Romance varieties alluded to in Sect. 4.2 above, where the local variant of PYTA is near- or wholly covert. Yet PYTA in Daco-Romance, contrary to expectations, is no more resilient than PYTA elsewhere: in some Daco-Romance varieties, PYTA retains perfect formal coherence, while in Aromanian (see e.g. Maiden 2011a) the distribution of the distinctive PYTA root is altered in accordance with the distribution of rhizotony, as happens in Italo-Romance varieties (see Sect. 4.2).

Comparison between PYTA and Fuèc is even more striking. While the constituent members of Fuèc in most Romance varieties have lost the meaning of obligation originally associated with the infinitive+HABERE construction and cannot be said to have a unique functional correlate, Fuèc does retain some shared morphosemantic feature content (albeit to varying degrees in different Romance varieties, cf. Esher 2013:114) where PYTA does not. As Fuèc and PYTA exhibit similar diversity of morphosyntactic values and, albeit impressionistically, of phonological properties, the major difference between their respective extramorphological coherence proceeds from the difference in morphosemantic coherence. Yet this distinction does not seem to bear on the relative resilience, or even salience, of the two distributions.

In the vast majority of Romance varieties, PYTA displays both [formal] 'coherence' and 'convergence' in the sense of Maiden (2005): formal identity is maintained across the constituent cells of this morphome (with only rare exceptions, Maiden 2011a), and distinctive PYTA roots typically come to resemble each other across lexemes. PYTA is very precisely targeted in cases of analogical levelling, defectivity and heteroclisis, whereas examples of Fuèc being affected by such processes are rarer, and often do not apply uniquely and unambiguously to this morphome (see e.g. Esher 2012; Smith 2013). The most striking difference, though, is the high number of counterexamples to formal coherence in Fuèc. In a corpus of Occitan dialect descriptions and linguistic atlas surveys which attest relatively few disparities between the stems of the preterite and the imperfect subjunctive for any given lexeme, cases of such disparity (or 'formal asymmetry') between the stems of the SF and SC occur in large numbers (Esher 2012, 2013, forthcoming) and are not repaired, unlike stem alternations which arise within PYTA in mediaeval French and Occitan. In other words, Fuèc, although apparently more motivated than PYTA, is less resilient.

Furthermore, although the degree of morphosemantic coherence in Fuèc differs between varieties of Occitan, this variation is not correlated with variation in formal coherence: the Languedoc varieties which present the highest density of formal asymmetries have substantially greater morphosemantic coherence for Fuèc than varieties of Gascony in which the formal coherence of Fuèc is almost exceptionless. Similarly, although the morphosemantic coherence of Fuèc in French is arguably greater than

in Italian (where the SC no longer shares the value of temporal posteriority with the SF), the formal coherence of Fuèc in Italian is just as systematic as in French.

The behaviour observed for PYTA and Fuèc indicates that simply having greater overall functional coherence is not a guarantee of greater formal resilience. However, the type of extramorphological correlate involved may have a role to play. For PYTA and Fuèc, all else being equal, greater morphosemantic coherence does not improve resilience, whereas in the Daco-Romance data, all else being equal, greater phonological coherence visibly increases the permanence of the U-pattern as compared to the L-pattern. The Daco-Romance examples suggest that a phonological correlate makes a greater contribution to long-term formal resilience than a morphosemantic correlate, a conjecture which is consistent with the repeated observation that it is phonology which is the key factor in introducing novel patterns of morphomic distribution: the majority of morphomic patterns identified by Maiden for Romance are attributed to the morphologisation of alternations created by sound change, while Esher (forthcoming) argues that formal asymmetry in Fuèc originates in a similar process. Maiden (2013a) also reports data from the history of Italian and Romanian, in which sensitivity to the phonological naturalness of a string acts as a limiting factor on the analogical spread of a novel morphomic pattern through the lexicon. For example, in mediaeval Italian (Maiden 2013a:35–38), root allomorphs characteristic of the present subjunctive are spread into the gerund of a number of lexemes: *possendo* 'being able', cf. 3SG.PRS.SBJV *possa*, occurs alongside etymological *potendo*, *vo*/ʎʎ/*endo* 'wanting', cf. 3SG.PRS.SBJV *vo*/ʎʎ/*a*, alongside etymological *vo*/l/*endo*. However, this change is blocked where it would introduce a velar-final allomorph: 3SG.PRS.SBJV *di*/k/*a* 'say' does not induce a gerund **di*/k/*endo* in place of the etymological form di/ʃʃ/endo with its palatal-final allomorph. Maiden attributes this restriction to the greater phonological naturalness of the sequence palatal + front vowel as opposed to velar + front vowel, and infers that innovating speakers use 'phonological cues as to the plausibility of any given innovation', concluding that '[a]n innovation apparently has a better chance of survival when it is phonologically natural [...] and/or when it occurs in a phonological environment which is consistently correlated with the relevant allomorph' (2013a:43). By contrast, I am not aware of any example in which change in morphomic distributions occurs primarily to reflect morphosyntactic or morphosemantic properties. The restriction of originally L-pattern alternants to the present subjunctive in most Gallo-Romance varieties is a consequence of sound change (Maiden, forthcoming), as are the developments in French which, in many lexemes, replace the N-pattern by an alternation between singular and plural forms in the present indicative (termed 'singular/plural pattern' by Smith 2011). Although these are cases in which correlation of morphomic distributions with extramorphological properties can be said to increase, neither change is motivated by any pressure to improve such correlation; instead, both result purely from regular sound change.

Other research points to the diachronic resilience of morphomic patterns being determined by factors independent of the extramorphological coherence of these patterns. Maiden (2013b) argues that the resilience of morphomes is due to a 'universal tendency to maximize the predictability of the relationship between form and lexical meaning' (2013b:520). Under this view, morphomic patterns are a means to systematic and predictable organisation of multiple forms with the same lexical meaning. It

follows that such patterns are only necessary among forms which share their lexical semantics, and that the value of such patterns to speakers, notably in acquisition, is directly related to their predictive power. If this view is correct, a pattern which allows the speaker to generalise reliably across lexemes, and/or to generalise across a high proportion of lexemes, is more likely to persist, and thus diachronic resilience is also dependent on factors such as the consistency in shape of a morphome across lexemes, and the sheer number of lexemes in which it is discernable. But the notion of predictability is also of interest in explaining the apparent difference between phonological and morphosemantic correlates, since consistent phonological correlates increase the predictability of a formal, morphomic pattern, particularly where (as in the Daco-Romance case) there is an element of phonological naturalness to the relationship between a morphomic alternant and its phonological context.

6 Conclusions

The present study makes the case for a more nuanced understanding of autonomous morphology, supporting the model proposed by Aronoff (1994) in which all mappings between form and meaning in inflectional morphology are mediated by an independent, morphological, component of the grammar, termed the 'morphomic level'. The Romance data reported here illustrate cases of morphomic distributions which are to some degree correlated with, or even motivated (though underdetermined) by, extramorphological properties, and cases of morphomic distributions which originally map onto one or more extramorphological features but progressively lose their association with these features. Both synchronically and diachronically, Aronoff's model is advantageous in accounting for the observed variation between distributions.

Extramorphological correlates may be of different types: discussion of the data presented here, and of the theoretical implications of a recent proposal for the classification of morphomes in terms of 'functional coherence', indicates that a morphomic distribution may display phonological, morphosyntactic and/or morphosemantic coherence. As this study demonstrates, the task of identifying and discriminating between the different types of coherence is not a straightforward one; and the importance of the templates defined at the morphomic level in distributing inflectional formatives of many different types further complicates the identification of phonological correlates. Nevertheless it appears important to separate morphosyntactic, morphosemantic and phonological coherence, both because these are qualitatively different phenomena evaluated by different types of evidence, and because they are not necessarily of equal importance for the behaviour of morphomic distributions. The data surveyed here suggest that morphosemantic correlates have little role in determining the diachronic resilience of morphomes, whereas phonological correlates are more important, as is the case in analogical change; thus the *type* of coherence may offer a better indicator of resilience than a measure of overall extramorphological coherence or a broad categorisation as 'overt' or 'covert'. The study has set out some methodological prerequisites to the essential task of developing a quantitative measure of coherence.

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References

Ackerman, F., Blevins, J. P., & Malouf, R. (2009). Parts and wholes: implicative patterns in inflectional paradigms. In J. P. Blevins & J. Blevins (Eds.), *Analogy in grammar* (pp. 54–82). Oxford: Oxford University Press.

Anderson, S. R. (2008). Phonologically conditioned allomorphy in the morphology of Surmiran (Rumantsch)'. *Word Structure*, *1*, 109–134.

Anderson, S. R. (2011). Stress-conditioned allomorphy in the morphology of Surmiran (Rumantsch). In M. Maiden, J. C. Smith, M.-O. Hinzelin, & M. Goldbach (Eds.), *Morphological autonomy: perspectives from romance inflectional morphology* (pp. 13–35). Oxford: Oxford University Press.

Anderson, S. R. (2013). Stem alternations in Swiss Rumantsch. In S. Cruschina, M. Maiden, & J. C. Smith (Eds.), *The boundaries of pure morphology* (pp. 8–23). Oxford: Oxford University Press.

Aronoff, M. (1994). *Morphology by itself*. Cambridge: MIT Press.

Barceló, G. J., & Bres, J. (2006). *Les Temps de l'indicatif en français*. Paris: Ophrys.

Bonami, O. (2012). Discovering implicative morphology. Unpublished paper given to Décembrettes 8, Bordeaux, 7 December 2012.

Corbett, G. G. (2012). *Features*. Cambridge: Cambridge University Press.

DeMello, G. (1993). *-Ra* vs. *-se* subjunctive: a new look at an old topic. *Hispania*, *76*, 235–244.

Dendale, P. (2001). Les problèmes linguistiques du conditionnel en français. In P. Dendale & L. Tasmowski (Eds.), *Le Conditionnel en français* (pp. 7–18). Metz: Université de Metz.

Dendale, P. & Tasmowski, L. (Eds.) (2001). *Le Conditionnel en français*. Metz: Université de Metz.

Esher, L. (2012). The morphological evolution of future, conditional and infinitive forms in Occitan. In A. van Kemenade & N. de Haas (Eds.), *Historical linguistics 2009* (pp. 315–332). Amsterdam: Benjamins.

Esher, L. (2013). Future and conditional in Occitan: a non-canonical morphome. In S. Cruschina, M. Maiden, & J. C. Smith (Eds.), *The boundaries of pure morphology* (pp. 95–115). Oxford: Oxford University Press.

Esher, L. (forthcoming). Formal asymmetries between the Romance synthetic future and conditional in Occitan varieties of the Western Languedoc. *Transactions of the Philological Society*.

Loporcaro, M. (2011). Syllable, segment and prosody. In M. Maiden, J. C. Smith, & A. Ledgeway (Eds.), *Structures: Vol. 1. The Cambridge history of the Romance Languages* (pp. 50–108). Cambridge: Cambridge University Press.

Lunn, P. V. (1995). The evaluative function of the Spanish subjunctive. In J. Bybee & S. Fleischman (Eds.), *Modality in grammar and discourse* (pp. 429–449). Amsterdam/Philadelphia: Benjamins.

Maiden, M. (2000). Di un cambiamento intramorfologico: origini del tipo *dissi dicesti* ecc., nell'italoromanzo. *Archivio Glottologico Italiano*, *85*, 137–171.

Maiden, M. (2001). A strange affinity: perfecto y tiempos afines. *Bulletin of Hispanic Studies*, *58*, 441–464.

Maiden, M. (2005). Morphological autonomy and diachrony. *Yearbook of Morphology*, *2004*, 137–175.

Maiden, M. (2009a). From pure phonology to pure morphology. The reshaping of the Romance verb. *Recherches Linguistiques de Vincennes*, *38*, 45–82.

Maiden, M. (2009b). Un capitolo di morfologia storica del romeno: preterito i tempi affini. *Zeitschrift für Romanische Philologie*, *125*, 273–309.

Maiden, M. (2011a). Morphological persistence. In M. Maiden, J. C. Smith, & A. Ledgeway (Eds.), *Structures: Vol. I. Structures the Cambridge history of the romance languages* (pp. 155–215). Cambridge: Cambridge University Press.

Maiden, M. (2011b). Allomorphy, autonomous morphology and phonological conditioning in the history of the Daco-Romance present and subjunctive. *Transactions of the Philological Society*, *109*, 59–91.

Maiden, M. (2011c). Morphomes and "stress-conditioned allomorphy" in Romansh. In M. Maiden, J. C. Smith, M.-O. Hinzelin, & M. Goldbach (Eds.), *Morphological autonomy: perspectives from romance inflectional morphology* (pp. 36–50). Oxford: Oxford University Press.

Maiden, M. (2013a). 'Semi-autonomous' morphology? A problem in the history of the Italian (and Romanian) verb. In S. Cruschina, M. Maiden, & J. C. Smith (Eds.), *The boundaries of pure morphology* (pp. 24–44). Oxford: Oxford University Press.

Maiden, M. (2013b). The Latin 'third stem' and its Romance descendants. *Diachronica*, *13*, 492–530.

Maiden, M. (forthcoming). Some lessons from history. Morphomes in diachrony. In A. Luís & R. Bermúdez-Otero (Eds.), *The Morphome Debate: diagnosing and analysing morphomic patterns*. Oxford: Oxford University Press.

Milin, P., Kuperman, V., Kostić, A., & Baayen, R. H. (2009). Words and paradigms bit by bit: an information-theoretic approach to the processing of inflection and derivation. In J. P. Blevins & J. Blevins (Eds.), *Analogy in grammar* (pp. 214–252). Oxford: Oxford University Press.

O'Neill, P. (2013). Morphomes and morphosyntactic features. In S. Cruschina, M. Maiden, & J. C. Smith (Eds.), *The boundaries of pure morphology* (pp. 221–246). Oxford: Oxford University Press.

O'Neill, P. (2014). The morphome in constructive and abstractive models of morphology. *Morphology*, *24*, 25–70.

Ravier, X. (1971–1993). *Atlas linguistique et éthnographique du Languedoc occidental (ALLOc), 4 vols*. Paris: CNRS.

Romieu, M., & Bianchi, A. (2005). *Gramatica de l'occitan gascon contemporanèu*. Bordeaux: Presses Universitaires de Bordeaux.

Smith, J. C. (2011). Variable analyses of a verbal inflection in (mainly) Canadian French. In M. Maiden, J. C. Smith, M.-O. Hinzelin, & M. Goldbach (Eds.), *Morphological autonomy: perspectives from Romance inflectional morphology* (pp. 311–326). Oxford: Oxford University Press.

Smith, J. C. (2013). The morphome as a gradient phenomenon: evidence from Romance. In S. Cruschina, M. Maiden, & J. C. Smith (Eds.), *The boundaries of pure morphology* (pp. 247–261). Oxford: Oxford University Press.

Touratier, C. (1996). *Le Système verbal français*. Paris: Masson & Armand Colin.

Vet, C., & Kampers-Manhe, B. (2001). Futur simple et futur du passé: leurs emplois temporels et modaux. In P. Dendale & L. Tasmowski (Eds.), *Le Conditionnel en français* (pp. 89–104). Metz: Université de Metz.

Wurzel, W. (1987). System-dependent morphological naturalness in inflection. In W. Dressler (Ed.), *Leitmotifs in natural morphology* (pp. 59–96). Amsterdam/Philadelphia: Benjamins.